

REMARKS/ARGUMENTS

Claims 1-4 and 7-16 are active.

The claimed invention provides a method for removing sulfur compounds contained in a hydrocarbon-containing gas. According to the invention as described in Claim 1, a hydrocarbon-containing gas is fed to a desulfurizing bed comprising two desulfurizing agents. Desulfurizing agent A comprises at least one metal component selected from the group consisting of Ag, Cu, Ni, Zn, Mn, Fe, Co, an alkali metal, an alkaline earth metal and a rare earth metal carried on a zeolite. Desulfurizing agent B comprises at least one selected from the group consisting of cerium oxide and a metal component-carried on a porous inorganic oxide. The metal component is at least one selected from the group consisting of Ag, Cu, Ni, Fe, Co, Si, an alkali metal, an alkaline earth metal and a rare earth metal, and the porous inorganic oxide is at least one selected from the group consisting of alumina, silica, silica-alumina and cerium oxide. No such method is disclosed or suggested in the cited combination of references.

The rejection of Claims 1-4 and 7-16 under 35 U.S.C. 103(a) over Takashi et al. (JP 2001-278602) in view of Feimer et al. (U.S. 2002/0157990) and Ward (U.S. 3,945,943) is respectfully traversed.

Takashi is directed to a method for removing sulfur contaminants from petroleum hydrocarbons, by contacting the petroleum hydrocarbon with a first desulphurization agent which is a **halide compound supported on a porous substrate** [0005] and [0007] (17th group element, preferably Bromine) and a second desulphurization agent such as Co-Mo/alumina or Ni-Mo/alumina [0010].

Takashi describes the function of the halogen (Bromine) is to form a sulfur bromide which is more easily adsorbed and therefore removed by a porous adsorbent [0007]. The primary reference also points to the severe conditions necessary for a hydrodesulfurization system such as Co-Mo/alumina and indicates that due to such difficult requirement, the

hydrodesulfurization cannot be readily employed to produce hydrocarbons for fuel cells [0003]. Applicants submit that such description, Takashi effectively teaches away from a process including hydrodesulfurization.

Feimer describes a process for removing sulfur compounds from hydrocarbon feedstreams via selective hydrodesulfurization employing a catalyst of a Group VIII metal (Co and Ni) with a Group VIB metal (molybdenum or tungsten) on a refractory support (Abstract)[0033]. The temperature and pressure ranges for the hydrodesulfurization are described in the table in [0030].

After hydrodesulfurization, Feimer describes an adsorption stage wherein the hydrodesulfurized stream is treated with an adsorbent containing cobalt with molybdenum and/or tungsten.

Therefore, Applicants submit that the secondary reference requires the hydrodesulfurization treatment process that Takashi teaches away from.

Ward describes a combination of zeolite and refractory inorganic oxides useful for catalytic and ion exchange processes (Abstract) and more specifically a hydrocarbon conversion catalyst. The catalyst of Ward is sulfided to convert the hydrocarbon as described in Example 2 (Col. 9, line 49). Moreover, this reference does not disclose or suggest the combination of two different desulfurizing agents.

In contrast, the object of the present invention is to provide a method for efficiently removing all sulfur compounds contained in a hydrocarbon, and specifically, carbonyl sulfide, dimethyl sulfide, t-butylmercaptan and dimethylsulfide. Ward does not describe such technology.

The Office has pointed to Col. 6, lines 37-50 of the secondary reference as showing a process similar to Takashi for the desulfurization of hydrocarbon feeds. The cited description is copied below (lines 37-46) for showing the error of the Office's statement:

These compositions presently demonstrate the greatest advantage in the area of hydrocarbon conversion. A wide range of organic, particularly hydrocarbon, reactions are promoted by **acid catalyzed or carbonium ion mechanisms** both in the presence and absence of hydrogen. The **most significant of these include** dealkylation, isomerization, catalytic cracking, hydrogenation, alkylation, dehydrogenation, dehydrocyclization, reforming, desulfurization, denitrogenation and hydrocracking.

Applicants submit that one of ordinary skill in the art would recognize that Ward is describing a desulfurization by chemical reaction such as dehydrosulfurization and not adsorption as described by Takashi. Again, Applicants submit that Takashi teaches away from the utilization of dehydrosulfurization.

The Office has alleged the combination of Takashi and Feimer and Ward, as follows (Official Action dated August 6, 2009, page 5, lines 3-10):

Thus, it would have been obvious to one skilled in the art at the time of invention to modify Takashi invention and use a combination of cerium oxide and Co-Mo/alumina as desulfurizing agent B as disclosed by Feimer because cerium oxide is functionally similar to alumina. It would also have been obvious to modify Takashi's desulfurizing agent A and use Co and one or more Group VI metals (such as Mo) in addition to Group 17 (bromine) on zeolite beta or faujasite to achieve the advantages as disclosed by Takashi . . . as well as Ward . . .

As previously described, Takashi points to the difficulty and efficiency of hydrodesulfurization and employs bromination as a method for improving the efficiency of an adsorption process. Therefore, the primary reference teaches away from a method including hydrodesulfurization.

M.P.E.P. 2145 X.D. 2. states:

It is improper to combine references where the references teach away from their combination.

MPEP § 2143.01 VI. states:

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.

Takashi requires a halogenation of the sulfur in the organic structure to render the compound more efficiently adsorbed. One of ordinary skill in the art would recognize that the combination of hydrogenation required by Feimar and suggested by Ward with the halogenation required by Takashi would render the Takashi process inoperable. The hydrogenation would reverse or prevent the formation of the sulfur halogen bond and no improvement of adsorption would be realized.

Applicants note that in reversing an obviousness rejection in *Ex parte SUSUMU TANAKA and YASUO MURAKAMI* (Appeal 2007-3845; Decided: March 28, 2008) the Board of Patent Appeals and Interferences stated:

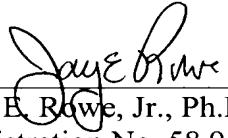
In order to establish a *prima facie* case of obviousness, the Examiner must show that each and every limitation of the claim is described or suggested by the prior art or would have been obvious based on the knowledge of those of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988). “[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)

As described above, Applicants respectfully submit that Takashi teaches away from hydrodesulfurization and the combination of hydrogenation described by Feimar and suggested by Ward would prevent or reverse the sulfur-halogen bond formation required by the primary reference. Therefore, the Office has not explained by articulated reasoning or rational underpinning how or why one would combine the references as cited. Accordingly the burden to support a *prima facie* case of obviousness has not been met and Applicants respectfully request that the rejection of Claims 1-4 and 7-16 under 35 U.S.C. 103(a) over Takashi in view of Feimer and Ward be withdrawn.

Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

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